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Tulsa Tornado Tribune

Where People Who Know the Weather Get Their Weather

National Weather Service Tulsa, Oklahoma **Spring, 2008**

Craig Sullivan - Editor

The Importance of Accurate Spotter Reports

Each year, the National Weather Service in Tulsa issues scores of severe weather warnings as a crucial part of our mission to protect lives and property. But, the process does not end once the warning is issued from this office.

Most severe weather warnings are issued based on our interpretation of incoming radar data and knowledge of the atmospheric conditions. While the warning is in effect, forecasters continue to monitor radar trends to determine if the warning needs to be continued, updated with a Severe Weather Statement, or if an additional warning is needed for the storm "downstream". The radar data helps this process, but it is only *guidance* for the warning forecaster. Actual ground-truth reports from trained spotters are needed to verify the warning; a radar estimate of 2 inch hail doesn't count!

What to Report

- Tornadoes
- Funnel Clouds
- Rotating Wall Clouds
- Hail - 3/4" or larger
- Wind Gusts > 50 mph (estimated/measured)
- Flooding
- Any weather related damage, or life-threatening event

Please do NOT Report heavy rain or lightning

A word about verification

When we refer to warning verification, we mean finding a report of severe weather that occurs within the warning area during the time the warning is in effect. Recall that for a thunderstorm to be severe, it must contain hail ¾ of an inch or larger and/or winds of 58 mph or greater. Verification statistics are complied for every severe weather event, from isolated thunderstorm events to major outbreaks.

In an ideal world, we would receive verifying reports for each warning during the event, but typically, less than half of warnings are verified as the event occurs. More likely, we have to hit the phones the next day in search of any verification we can

Accurate Reports *Continues on page 6*

Something for Everyone?

Variety, it is said, is the spice of life. The winter of 2007-2008 provided plenty of it, with a major ice storm, a rare January severe weather outbreak, and even a large fire to name a few. On pages 2-5, we will summarize the significant events of the season.

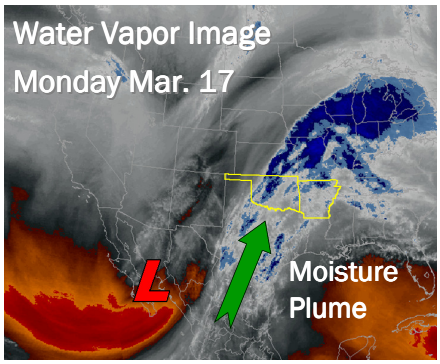
Scenes like the one below were all too common after the December 9-10 ice storm. *Photos by Bruce Sherbon - NWS Tulsa forecaster*

Inside this issue:

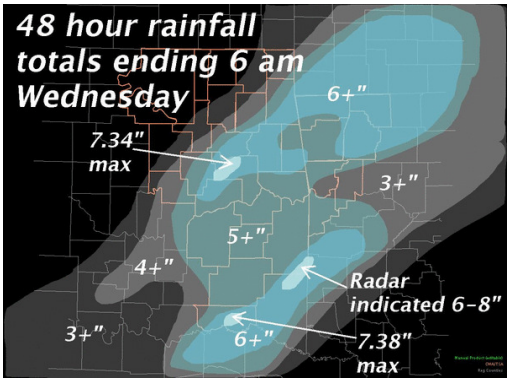
Early Spring Floods

Widespread rainfall of 3 to 6 inches affected the region during the three day period from March 17-19, leading to widespread flash flooding as well as significant river flooding.

The forecast confidence for heavy rain began to increase several days ahead of time as the computer models remained consistent with a strong storm system affecting the area. The heavy rain potential was first mentioned in the Hazardous Weather Outlook the Thursday before the event. Subsequent outlooks, forecast discussions, and flood watches continued to highlight the heavy rain threat through the weekend and into the event itself.



It all came together as a strong upper-level low dug into southern California and the desert southwest. A deep plume of moisture began to flow into the region ahead of the upper low by the 17th. By Tuesday morning, the 18th, the closed low moved into west Texas and strong southerly flow continued to bring copious moisture toward the region. As a result, the atmosphere became nearly saturated through a very deep layer...at least 10,000 feet...and this proved to be more than enough for widespread heavy rainfall.



Rainfall amounts based on rain gages and radar estimates ranged from around 1 inch in northwest Osage county, to over 8 inches in southeast Oklahoma. Floods caused hundreds of roads, including many state highways, to be closed. Mainstem rivers began to rise across the area, with several points experiencing moderate to major flooding. The Illinois River near Watts, OK, reached its third highest stage on record.

In addition to the heavy rain, severe thunderstorms affected the area Monday night and into late Tuesday morning. A bow echo developed in Sebastian County in west central Arkansas, bringing damaging straight-line winds in Charleston and Branch. A weak tornado later developed within this squall line and caused EF1 damage near Peter Pender.

The Danger of Automobiles

Flooding is the leading cause of weather fatalities, and almost half of flood-related deaths occur in automobiles. Both(?) flood fatalities in the NWS Tulsa CWA this year were due to cars driving over a flooded road.

Why are flood waters so dangerous to drive through? It's a simple matter of Physics...something called buoyancy. The same principle that allows a 97,000 ton aircraft carrier to float works for a car too.

How does it happen? For each foot of water that rises up its side, an average vehicle displaces 1,500 pounds of water; in effect this makes the vehicle weigh 1,500 pounds less! Based on this, a depth of about 2 feet will carry away most automobiles.

What about trucks and SUV's? They should fare better because of their size and higher clearance, right? Not really...with their heavier weight, they displace even more water. For example, a full-size crew cab pickup weighing 5,000 pounds actually displaces about 6,700 pounds of water for each foot! Also, the larger tires typically found on these vehicles add to their buoyancy.

Another thing to remember...flood waters conceal the road's condition. It may well be washed out underneath what appears to be a few inches of water. Simply put... it's not worth the risk!

Flood waters in LeFlore County, OK

Another Ice Storm

2007 concluded much as it began…with an icy mess covering a large part of eastern Oklahoma and northwest Arkansas. The set-up for this event was not unlike the one in January, 2007; a shallow arctic airmass plunging south while a deep upper level low pressure system fed warm and moist air over the shallow cold dome. To make matters worse, the air above the cold dome was also quite unstable, which resulted in embedded thunderstorms and locally very heavy freezing rain rates.

While surface temperatures warmed above freezing over much of the affected area by the next morning, the damage was already done. Clean-up is still going on in many locations as of mid-March.

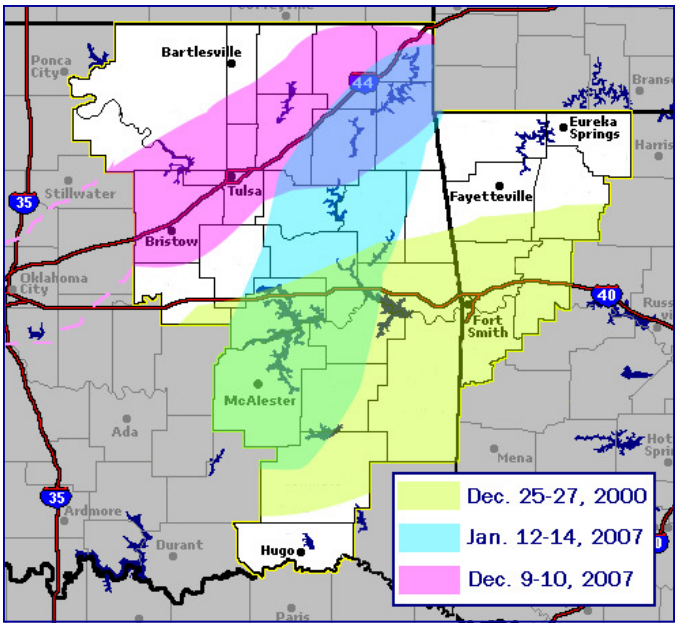
One difference in the impact of this ice storm, versus the one in January, was that ground temperatures were just warm enough to prevent freezing on roadways…but fallen limbs and power lines caused enough travel headaches as it was. One positive note…wind speeds remained relatively light through the event. Had wind speeds been 15 mph or more, the damage would likely have been catastrophic.

This event provided an excellent example of how forecaster experience can significantly improve over guidance predictions even several days in advance. While the medium range model solutions painted a warmer picture a week before, an experienced and knowledgeable forecaster was able to recognize that the models were likely too slow with the arctic front, and was thus able to make the call of a potential winter storm well before any models suggested the same.

The Worst of Them All?

The statistical toll of the January 10-11 ice storm is staggering…over 600,000 residents without power at the height of the storm, hundreds of thousand of dollars in damage, and 30 deaths…making it perhaps the costliest ice storm in Oklahoma history.

However, from a strictly meteorological standpoint, this storm doesn't quite measure up to some of the bigger ice storms of recent years! Ice accumulations were mostly in the one to two inch range…certainly enough to cause damage. However, the January, 2007 storm saw ice accumulations of 2 to 3 inches over a wide area, and up to 5 inches in a few areas. The December, 2000 storm that affected southeast Oklahoma saw even greater accumulations! So, why then, was this most recent one so destructive?



Comparing the approximate "footprints" left by the three biggest ice storms since 2000

Ranking the Storms

	Ice Accum.	Max Ice Accum.	Power Outages*	Fatalities*
12/00	3-4"	~6"	200,000	26
1/07	2-3"	~5"	120,000	32
12/07	1-2"	~2"	640,000	30

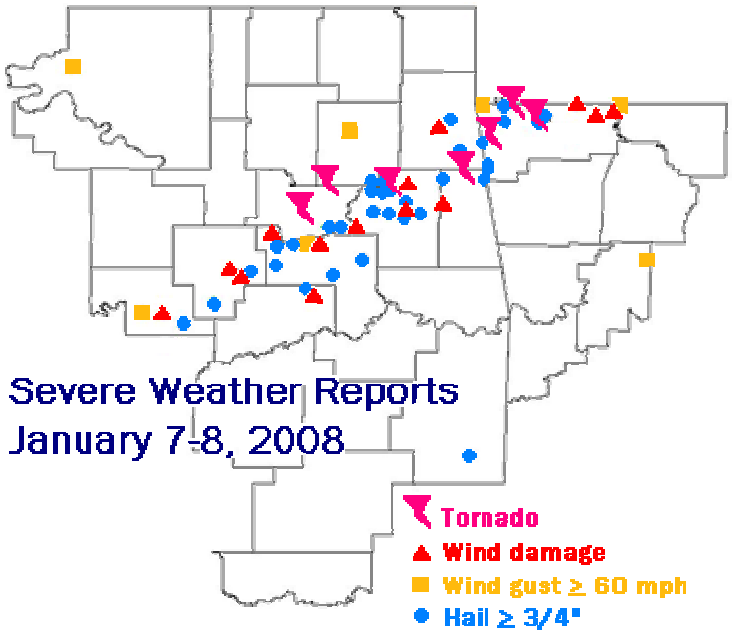
** Statewide totals*

Much like in real estate…the three main factors were location, location and location. The December, 2007 ice storm was concentrated along and near the Interstate 44 corridor, which happens to include BOTH Oklahoma City and Tulsa, while the other storms affected less densely populated areas. Had an ice storm similar to that of December, 2000 affected the same area, the results would have been MUCH worse!

January 7 Severe Weather

Spring made an early appearance as an unseasonably warm and moist airmass combined with a strong system to spawn numerous severe thunderstorms on the evening of January 7. This outbreak produced 7 tornadoes...more than all of last year in Tulsa's forecast area...along with wind damage and flash flooding. The main impact was in an area from Okfuskee and Okmulgee counties, northeastward through Benton County.

In all, NWS Tulsa issued 21 storm-based tornado warnings (53 county warnings)...8 of which verified with average lead time of 34 minutes. Warning operations were complicated by the very fast movement of storms...nearly 60 mph to the northeast in some cases...and the fact the storms were mostly concentrated in a narrow corridor. Many locations were impacted by multiple severe storms during the evening, making after-the-fact warning verification very challenging!



Notable Winter Tornadoes

On February 5, 2008, eastern Oklahoma and northwest Arkansas narrowly missed out on what became one of the deadliest winter tornado outbreaks in years. The "Super Tuesday" outbreak produced at least 82 confirmed tornadoes from central Arkansas through the Tennessee and Ohio valleys, with 58 fatalities. While tornadoes are relatively rare from December through February, several of note have occurred in this area during the winter months.

1/22/57 - F4 tornado kills 10 and injures at least 20 in Gans, OK...2 other F2 tornadoes reported in Okfuskee and Haskell Counties.

1/25/67 - A pair of F2 tornadoes track through Rogers, Mayes, Craig and Ottawa Counties, injuring 8.

12/21/67 - F2 tornado in Sebastian County, on the southeast side of Fort Smith, injuring 6. Part of a large outbreak affecting the mid and upper Mississippi valley.

12/5/75 - F3 tornado injures 38 and causes 5 million in damage in midtown Tulsa. Another F3 tornado tracked from near Okmulgee to Coweta, while F2 tornadoes were reported near Bixby, OK and Wilburton, OK.

12/23-24/82 - Two day outbreak of 42 tornadoes from eastern Oklahoma through Arkansas and southern Missouri. On the 24th, an F2 tornado injures 7 in south Tulsa, while an F1 tornado injures 10 near Ketchum, OK.

Time	County	Location	Length	Width	Rating	Basis
805 PM	Benton	2 S Hiwasse	0.1 mi	50 yd	EF0	Spotter report - no damage
808 PM	Adair	4 SW Watts	0.1 mi	50 yd	EF0	Spotter report - no damage
850 PM	Benton	4 E Centerton	0.1 mi	50 yd	EF0	Spotter report - no damage
1028 PM	Cherokee	2 NW Moodys-2.4 N Moodys	1.8 mi	0.3 mi	EF0	Trees uprooted, 2 barns damaged, roof damage to house
1109-1112 PM	Benton	3 NW Gentry-2 SW Decatur	2.6 mi	85 yd	EF1	Extensive hardwood tree damage
1138 PM	Wagoner	2 NE Porter	0.5 mi	75 yd	EF0	Tree damage
1154-1158 PM	Wagoner	5.5 NE Wagoner-8.2 NE Wagoner	2.7 mi	85 yd	EF0	Extensive tree damage

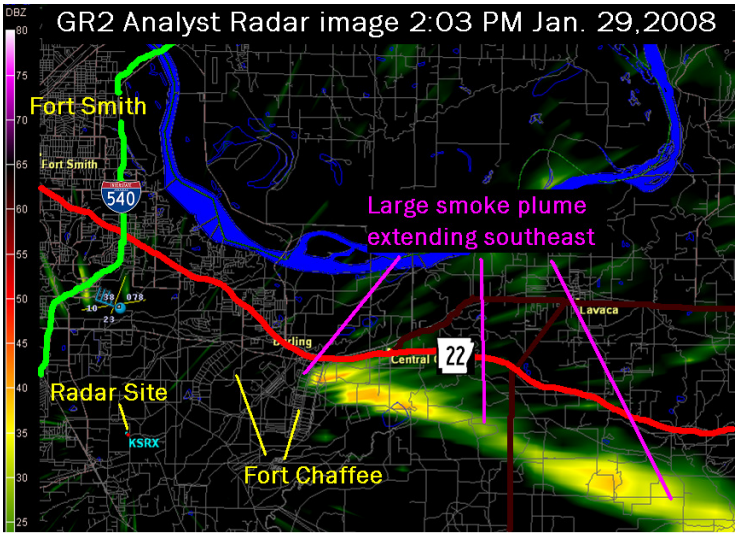
When a **Tornado Watch** is issued by the Storm Prediction Center, it means conditions are favorable in and near the watch area for tornadoes to occur. Monitor later forecasts and be prepared to take action.

When a **Tornado Warning** is issued by the National Weather Service in Tulsa, a tornado is either imminent or already occurring. Take action immediately!

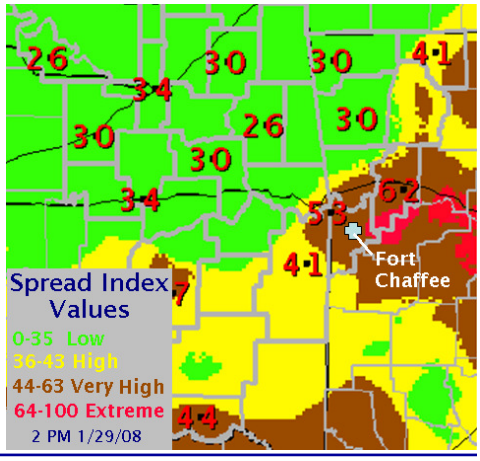
Fort Chaffee Fire

January 29 started very warm and breezy, with most areas in the 60s at daybreak, but a strong cold front quickly brought an end to all of that by mid morning. Northwest winds gusting over 40 mph and temperature drops of almost 30 degrees in 2 hours were noted behind the front. By noon, the front had entered the northwest corner of Arkansas and was plowing through southeast Oklahoma...bearing down on the Fort Smith area. Temperatures had already dropped into the upper 20s near the Kansas border, while temperatures warmed to near 70 south of the front with southwest winds gusting to near 40 mph.

Around the same time, firefighters were dispatched to a structural fire near Fort Chaffee, Arkansas...a military base near Fort Smith. The strong winds caused the fire to quickly jump from one building to the next, and dozens of structures were soon engulfed in flames. The wind shifted to the northwest as the front pushed through around 1 PM. A peak wind gust of 55 mph was recorded at Fort Smith Regional Airport. The fire ultimately destroyed 150 World War II era buildings that were once part of the base, and injured one firefighter. State Highway 22 was closed for several hours.



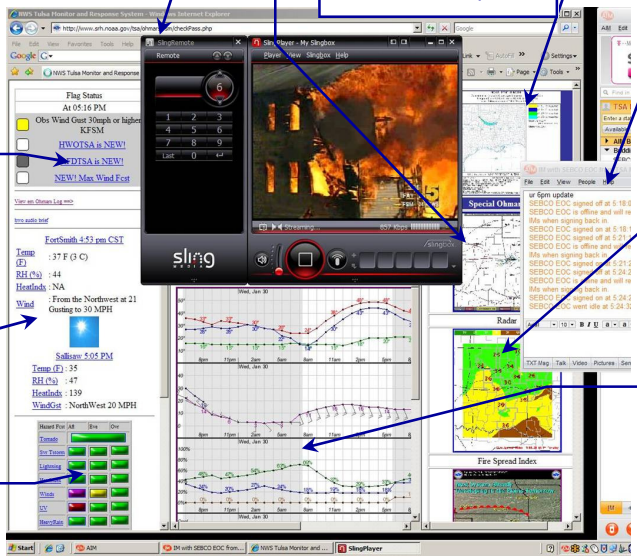
ABOVE: Radar image shows the large smoke plume from the Fort Chaffee fire.



RIGHT: The Spread Index at 2 PM shows an area of very high to extreme values near the Fort Smith area.

OHMARS in Action

The OHMARS webpage allowed NWS Tulsa forecasters to provide critical forecast support in the effort to contain the Fort Chaffee fire through the use of gridded forecast data. Here is an example of the services provided.



NWS Forecasters watch the fire from AR TV stations via the Internet.

Radar display used to monitor smoke plume.

NWS Forecasters run HYSPLIT out of concern that potentially dangerous materials could be involved.

Instant Messaging with Fire Command Post answering questions from the Incident Commander and EMs.

Audio and Visual Alarms for changes in current conditions, NWS text products, and grids.

Hourly updates on Fire Spread Potential, derived from forecast grids.

Current weather conditions in Fort Smith.

WFO Tulsa assigned an Incident Meteorologist to provide hourly updates to grids, which gave the command post high-resolution forecast meteograms for the site.

Grid-based hazard potential for Sebastian County.

Accurate Reports

(Continued from page 1)

get. This can be taxing after a major outbreak…especially one where multiple storms impact the same area…or on days when we have to get the phone calls out of the way early before the next round of severe storms comes along that afternoon.

The truth is…we don't get enough reports! Trust me; there has never been a severe weather event where a meteorologist says, "I wish these reports would stop!" The message here is; do not hesitate to report severe weather, EVER! If we have already received 12 reports from a storm, we will gladly take a 13th!

Of course, reports need to be accurate, especially the time, location and magnitude of the event.

When Reporting

- Identify yourself
- Report event location, and be as specific as possible
- Report the time of observation

Actual time of event

Since most of the reports we receive are delayed at least slightly, it is important that you give the actual time the severe weather occurred. If you observed a damaging wind gust 20 minutes ago, be sure and tell us that when you give us your report. This can be difficult if you are giving the report a day or two later. In that case, give us your best estimate.

Storm or event location

This has become even more critical with the advent of storm-based warnings within the past year.

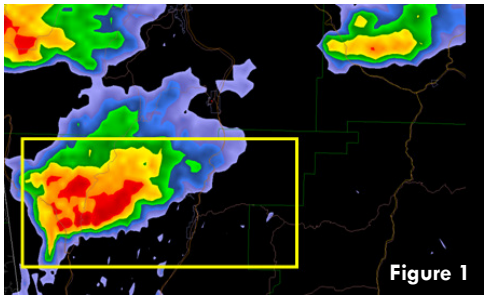


Figure 1

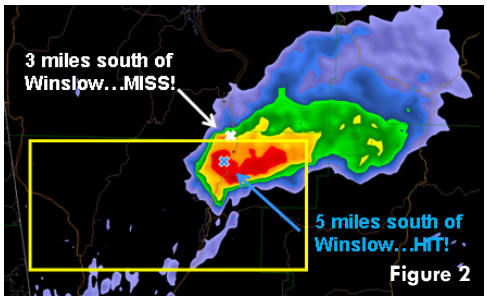


Figure 2

Consider the following example. A storm has rapidly intensified, and a warning is issued (*Figure 1*) for large (1 inch) hail, valid for one hour. A spotter reports 2 inch hail 5 miles south of Winslow 15 minutes later. The map (*Figure 2*) shows this is well within the "box" and thus, the warning has verified. Not only that, based on this report and radar trends, a new severe weather statement is issued to indicate hail 2 inches or larger can be expected.

Another report comes in at approximately the same time…but from 3 miles south of Winslow. The town is outside of the "box", and if this report is indeed accurate, this is a miss and a new warning may need to be issued. But, from the radar data (*Figure 2*), this looks questionable as the reflectivity core is south of that location. If the location was inaccurate in this case, it could prompt a warning that was not necessary.

Sometimes, of course, this can be a simple matter of misunderstanding… especially when the report goes through multiple channels. For example, a spotter may report; "I am 3 miles north of Dullsville on highway 1…I see a tornado on the ground approximately 5 miles to my northwest, and it appears to be moving due east". But as this report is relayed a few times, the report is received by the National Weather Service as "There's a tornado in Dullsville."

Measure if at all possible

When it comes to documenting severe weather reports after an event, an accurately measured event carries more weight than estimation. While we do not expect hail size to the nearest tenth of an inch, or wind speeds to the nearest mile-per-hour (very difficult without fancy instruments!), we do strive for accuracy. Hail sizes should be reported comparing to an object of known size…a baseball for example… and vague comparisons such as "marble size" (shooter vs. peawee) are not to be used. As for wind speeds…unfortunately they are much more subjective. In the absence of measuring equipment, you simply have to use your best judgment. The Beaufort scale may help. Of course, any significant wind damage should be reported. For example, 4 inch diameter tree limbs down is considered significant… light-weight patio furniture blown over is not.

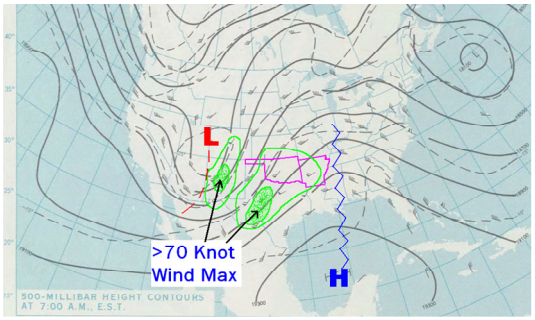
Most Importantly

It's not a stretch to say we couldn't do our jobs without the help of trained spotters! We thank each of you for your time and your contributions…and we look forward to getting your reports!

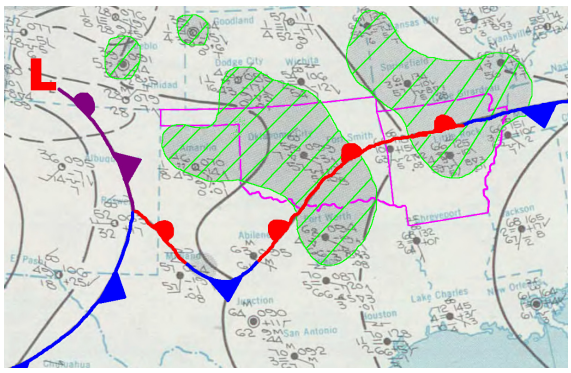
40 Years Ago - 1968 Greenwood, Arkansas Tornado

Greenwood, Arkansas was devastated 40 years ago this spring, when a powerful twister, rated an F-4, swept through the heart of the community on the afternoon of April 19, 1968. The tornado tore through the southern portions of Greenwood, including the main business square, at around 3:15 PM that afternoon. Within minutes, most of the business section, dozens of homes, the three-story Courthouse and City Hall were demolished. Fourteen residents ultimately lost their lives, with at least 200 injured.

The death toll might have been even higher if the twister had struck only a few minutes earlier. The storm unleashed its fury on the High School shortly after the students had been dismissed for the day; no students were among the injured. Many other residents were spared from the storm as they were at work in Fort Smith, 12 miles to the north.



The 500 mb height chart from the morning of April 19, 1968 showed a significant upper level trough to the west, with a strong speed max pushing into western Arkansas.



At the surface, a warm front was situated near the Arkansas River valley, with dew points in the mid 60s just to the south. Locally backed surface winds near the warm front likely increased the tornado potential.

Although the tornado was only on the ground for four minutes, the effects lingered for weeks. The devastation was described by one Arkansas state trooper as rivaling "the aftermath of World War II bombing raids." Resources were dispatched from nearby towns in both Arkansas and Oklahoma within minutes after the devastation. Scores of ambulances, police units, emergency assist teams and private vehicles descended on the town to assist in rescue and recovery efforts. The dead and injured were taken to hospitals in nearby Fort Smith and Van Buren for several hours after the storm. Dozens of less severe injuries were treated at the scene by Red Cross and medical personnel who had set up emergency stations amid the destruction.

Clean up continued through the night and the next day as civil defense crews continued to search for more victims. All telephone, electric and water services were knocked out, but by noon the next day, lineman had installed six telephone lines at the Greenwood telephone office, allowing residents to contact loved ones. Two dairies from Fort Smith hauled water into town the next day.

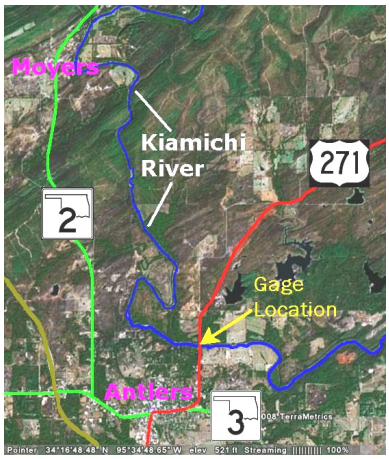
Total damage was estimated at around $1.5 million (1968 dollars). Over half of the structures in town were destroyed or severely damaged. The tally included 98 homes destroyed and 108 more severely damaged. In addition, 35 business buildings and 5 public buildings were destroyed or severely damaged. Outside the community, 19 farm buildings and two mobile homes were destroyed.

The Greenwood tornado was part of a system that produced 12 tornadoes that afternoon from north central Texas, across eastern Oklahoma and central Arkansas. The town of Howe, Oklahoma, about 30 miles to the southwest in LeFlore County, was hit about an hour before Greenwood. There were a couple of minor injuries reported along with significant damage to a gas station and one home. Straight line winds and large hail also caused considerable damage in Sequoyah County.

This tornado occurred in an era well before Doppler radar, when visual confirmation was often needed before a tornado warning could be issued. The tornado first touched down near the business district and was only on the ground for about four minutes. Unfortunately for residents of Greenwood, there was not much lead time before the tornado actually struck. Doppler radar likely would have been able to identify rotation within the storm several minutes before the tornado formed... potentially giving residents of Greenwood a few critical minutes of warning to take precautions.

New River Forecast Point

The National Weather Service in Tulsa has established a new river forecast point on the Kiamichi River near Antlers, OK. After coordination with the Arkansas-Red Basin River Forecast Center, the flood stage was set at 25 feet. The new service began December 20, 2007.



During an event on July 3, 2007, the Kiamichi River near Antlers crested at 34.51 feet. Campgrounds along the Kiamichi River near Moyers were severely flooded. In October, the NWS surveyed the flooded area and met with the campground owner. It was determined that permanent structures at the campgrounds are flooded when the river reaches a level between 25 and 26 feet at the Antlers gage. After coordinating with local emergency management officials, a preliminary flood stage of 25 feet was set. Flood forecasts will now be issued when the river is forecast to rise above 25 feet.

StormReady Okfuskee County

Congratulations to Okfuskee County, OK, on becoming the latest StormReady county. The county was officially recognized in November, 2007. There are now 16 counties and 15 communities in the NWS Tulsa forecast area with StormReady certification.

From left: WFO Tulsa MIC Steve Piltz, Commissioners Bruce Smith and Dale Fipps, Emergency Management Director Bill Elliott, Commissioner Max Henry.

In Other News

Bronze Medal

For the second year in a row, NWS Tulsa has received a Department of Commerce bronze medal. This year, the award was given for developing interactive analysis techniques that prevented loss of life during the March 12, 2006 tornadoes, which damaged or destroyed 300 homes along 65 miles of damage paths. The severe weather forecast parameters are derived from hourly gridded forecast data, and have continued to pay big dividends to NWS Tulsa meteorologists during recent severe weather events.

Multimedia Weather Briefings

If you see this icon on the Decision Support Page, click on it to view the briefing.

You may have noticed a new feature showing up on the Decision Support Page from time to time. NWS Tulsa meteorologists have begun using new software to create on-line weather briefings, which have been very well received by the emergency management community. We have also used this feature for summarizing significant weather events in our area.

NOAA Weather Radio Outreach

Several staff members from both WFO Tulsa and the Arkansas-Red Basin River Forecast Center participated in an outreach effort, in conjunction with three Wal-Mart stores in the Tulsa area, to promote NOAA Weather Radio. Staff members were on hand to answer questions and to help people with SAME code programming when they purchased a radio. The SAME coding feature allows listeners to program for tone alerts for their specific county or counties.

McReady Oklahoma Receives Award

The McReady Oklahoma program has received an award from the International Association of Emergency Management. The severe weather preparedness initiative earned First Place in the Public Awareness category! April is McReady month in Oklahoma.